On The Role of Wetting, Structure Width, and Flow Characteristics in Polymer Replication on Micro- and Nanoscale - DTU Orbit (08/11/2017)

On The Role of Wetting, Structure Width, and Flow Characteristics in Polymer Replication on Micro- and Nanoscale

The replication of functional polymeric micro- and nanostructures requires a deep understanding of material and process interrelations. In this investigation the dewetting potential of a polymer is proposed as a simple rationale for estimation of the replicability of functional micro- and nanostructures by injection molding. The dewetting potential of a polymer is determined by integrating the spreading coefficient over the range from melt temperature to no-flow temperature. From all polymers tested, the lowest dewetting potential is calculated for PP and the highest for polymethylmethacrylate. The dewetting potential correlates well with the replicated height of four different structures covering both the micro- and the nanorange on two different surfaces (brass and fluorocarbon modified nickel) and polymers with different spreading coefficients. It is clearly shown that a lower dewetting potential of a polymer leads to a better replication accuracy. Additionally a parabolic relationship is demonstrated between filled height and structure width.

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